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coast in very late geological time (see *Proceedings U. S. National Museum,* **1**, 3, 1878) add a certain plausibility to it, taken in connection with the facts above recorded of the geographical distribution of the shore mollusca.

It should be noted that the Pleistocene fossils collected on the Galapagos Islands by Mr. Ochsner contain no traces of the northern fauna, though plainly of American derivation and with hardly any intrusion of Indo-Pacific forms. Also that the northern species mentioned appear in the Pleistocene and even older beds of the California coast from San Pedro to San Diego.

A somewhat analogous overlapping of faunas occurs on the southeastern coast of Alaska where a considerable number of boreal mollusks, as well as one of the Arctic hair seals, extend southward in the cold waters of the inland passages of the Alexander archipelago, following the low temperature of the water induced by the drainage from glaciers and the shadows of the highlands bordering these narrow passages which, with the prevalent fogs, cut off most of the sunlight. On the outer fringe of the archipelago where the more normal sea temperatures occur, numerous representatives of the Californian fauna find their way northward at least as far north as the latitude of Sitka, and very likely to Cross Sound.

SOME PSYCHO-PHYSIOLOGICAL PROCESSES AS AFFECTED BY ALCOHOL

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The difficulty of adequately measuring the effects of small amounts of ethyl alcohol upon the human organism is indicated by the number of investigators who have worked in this field, by the variety of methods that have been employed, and more especially by the contradictions in the results. It is impossible to harmonize the published data because of the many and unknown variables. If two investigators would independently employ the same apparatus, methods, doses, subjects, and general conditions, the two sets of results would be comparable and seemingly of unique importance. It is the object of this paper to report a comparison of measurements made under such conditions.

Subsequent to the experimentation which is the basis of the extended report by Dodge and Benedict[1] arrangements were made with one of their normal group (Number VI) for a second series of measurements.

This subject had served during parts of twenty days, in all approximately seventy hours well distributed over a period of six months. The fact that he had showed the smallest positive effect of the alcohol was an especial reason for selecting him for the later tests.

During this second series of six consecutive days (June 29 to July 4, 1914, inclusive) the subject, who was a medical student,[2] was free from the usual duties of the school year. Although serving part of the time as an intern in a nearby hospital, he regarded the period as a vacation and could thus carefully regulate his daily habits. The last food before each experimental session was a hearty meal taken seven hours previously from which coffee and tobacco were excluded. No alcohol was taken during the week other than that given in the laboratory. The experiments began at 8 a.m. and continued until 1 p.m., thus providing a total session of five hours as contrasted with the three hour periods employed by Dodge and Benedict. In the former series the subject was working intensely and an effort was made to guard against any weekly rhythm that might exist on this account by having all the experiments come on the same day of the week. In our experiments there seemed no such logical reason for extending the sessons over a period of weeks; consequently the measurements were made on consecutive days, the alcohol being given on the second, fourth and sixth days. The giving of alcohol doses in this frequency may present the possibility of an additive effect. However, such an effect would apply even more to the normal days and thus theoretically a smaller resulting difference would be shown.

The alcohol for each day was given in a single portion. The dose used was that designated by Dodge and Benedict as 'Dose A,' which contained 30 cc. of absolute alcohol, 7 cc. of orange infusion,[3] 1 cc. of a strong infusion of quassia, a slight amount of saccharine for sweetening, and water to bring the volume to 150 cc. A mixture of the same volume and composition, but without the alcohol, served as the control dose for each of the three normal days. In giving the two mixtures, every effort was made to prevent the subject from distinguishing between the alcohol and control days and he had no way of knowing before the session what the dose for that particular day was to be. As the alcohol frequently produced sensations of warmth in the stomach and flatulency, the subject never failed to identify the mixture before the experiment was over, although he received no confirmatory information regarding his impression. Unfortunately only the 30 cc. dose could be used in the second series. This was in accordance with the expressed desire of the subject who insisted that the 45 cc. dose, which he had taken three times in the previous series, made him feel uncomfortable for the rest of the day.

For the detailed technique of the various measurements used reference must be made to the careful description by Dodge and Benedict. There were but few minor changes in procedure since it was the intention to repeat the measurements of the first series with the same apparatus and as nearly the same conditions as practicable. In outline the experimental cycle was as follows: (1) Preliminary adjustments; placing of the electrodes for electrocardiograms from body leads; taking of data concerning the subject's general condition. (2) Patellar reflexes stimulated by two pendulum hammers of known weight; separation interval 0.5 seconds, latency and amplitude recorded from the thickening of quadriceps muscle. (3) Sensory threshold for Faradic stimulation measured in β-units, method of Martin. (4) Reaction time in reading isolated 4-letter words these being the same set of 24 words that was previously employed. (5) Finger movements, a modified form of the tapping test recorded photographically. (6) Voluntary tetanus designed to produce rapid fluctuations in the pulse rate. (7) Memory test for series of twelve 4-letter words. The same lists of words were used on each day and in the same order. (8) Eye reaction to peripherally appearing stimuli, photographically recorded. (9) Eye movement speed and accuracy in looking successively at marks separated by 40 degrees. (10) Protective lid reflexes stimulated by two sharp noises, separation interval 0.5 seconds, the photographic record being the shadow of the eyelash movement. (11) Pulse records (electrocardiograms from body leads) each approximately 15 seconds in length. Eleven such records were taken during each experimental cycle.

At the beginning of the second experimental period the subject drank the dose for the day, i.e., either the alcohol mixture or the control mixture. Then followed the patellar reflexes and other measurements in rotation as outlined. These were repeated in the same order in each experimental period. Theoretically, for purposes of comparison, the periods on the experimental days should be equal in number and length, but this ideal of regularity is hard to attain. During the six days, however, there was no accidental interruption which caused the omission of any measurements or enforced a delay of more than ten minutes for the adjustment or repair of apparatus. To complete a period required about one hour. This was approximately twice as long as the periods employed by Dodge and Benedict as in their series all of the measurements were not made on the same day.

In addition to providing for an equal number of normal and alcohol days, the first period of each day was also normal since the dose was not given until the beginning of the second period. Thus the first period values for each particular day serve to indicate the neural condition of the different processes measured. In the results presented emphasis is placed on the differences between the values obtained for the first period of the day and those obtained for succeeding periods of the same day as indicating the effect produced by the alcohol. To obtain the average difference for any particular day and any particular measurement, therefore, the value for the first period is deducted from the values for the succeeding periods, and the algebraic sum of the individual differences is divided by the number of periods succeeding the taking of alcohol. Such a method, while seemingly indirect, presents the effects of alcohol in a less contaminated form than does the simple comparison of the average values for the different days, as the experimental days are subject to changes in the level of nervous excitability. It cannot, however, be assumed that changes will not occur in the 5-hour period, although they are likely to be smaller than between different days.

With this subject the effects of alcohol do not always retain one direction throughout the experimental day, for a depression during the the first two periods after taking alcohol may change to a facilitation during the last hour or more of the session. To average either the measurement values or the differences between the first and succeeding periods under these conditions would therefore mask important tendencies. The results must be presented in a more analytic form.

A summary of the findings for the different experimental periods following alcohol together with the comparable averages found by Dodge and Benedict both for their normal group and for Subject VI individually are shown in table 1. The values given are the percentile effects of alcohol on the various processes in question, a plus showing increase and a minus decrease, which signs must be interpreted according to the nature of the measurement. Similar processes have been grouped in the table by sections. The first value in Period 2, Section 1, + 3.4 shows that the patellar reflext latency (L′, first reflex) was lengthened 3.4% in the first measurements made after taking alcohol as compared with the condition that existed in the period immediately after the taking of the control mixture. This lengthening of the reflex time was also present in the third and fourth experimental periods (+0.9 and +1.5) but not in so great a degree. In the fifth and sixth periods the sign changes, representing a shortened reflex time.

Since in the later series slightly more than 4 hours experimentation followed the drinking of the dose it is obvious that an average for Periods

2 and 3 is most directly comparable to the former results. A column of such averages is included in the table to aid comparison. This average for the patellar reflex, L′, is +2.1 as compared with +11.1, the average for the Dodge and Benedict normal group. The earlier result for Subject VI alone is +0.3, which although not large shows him to be in line with the normal group and also with his later percentages for periods 2, 3 and 4.

TABLE 1

THE PERCENTILE EFFECTS OF THE INGESTION OF 30 CC. OF ABSOLUTE ALCOHOL ON A RELATED GROUP OF PROCESSES

PROCESSES MEASURED	EXPERIMENTAL PERIODS FOLLOWING THE TAKING OF ALCOHOL					AVERAGE OF PERIODS 2 AND 3	RESULTS FOUND BY DODGE AND BENEDICT WITH EQUIVALENT DOSE	
	Period 2	Period 3	Period 4	Period 5	Period 6		Average for normal group	Average for Subject VI
Section I								
Patellar reflex								
Latency, L′	+ 3.4	+ 0.9	+ 1.5	− 7.4	− 3.4	+ 2.1	+11.1	+ 0.3
Latency, L″	+ 0.8	+ 4.0	+ 5.8	−15.1	−10.6	+ 2.4	+ 4.0	
Lid-reflex								
Latency, L′	+13.6	+ 5.8	− 2.9	+6.4	+ 4.3	+ 9.7	+ 5.9	− 4.5
Latency, L″	+15.1	+ 1.8	− 7.5	− 3.8	+ 3.8	+ 8.4	+ 6.8	−10.7
Eye reaction time	+15.5	+16.4	+14.7	+11.8	− 1.9	+15.9	− 5.4	− 9.3
Word reaction time	+ 3.2	− 8.2	− 7.4	−10.6	−20.8	− 2.5	− 1.0	−26.0
Faradic sensory threshold	+31.0	+20.4	+18.2	+24.9	− 8.3	+25.7	+21.0	+48.0
Eye movement velocity. Rt. movements	+19.3	+ 6.4	+ 2.1	− 1.4		+12.8	+ 3.4	+25.8
Section II								
Patellar reflex								
Amplitude, A′	− 2.5	+ 3.3	−22.7	−42.0	+ 5.0	+ 0.4	−60.3	+13.0
Amplitude, A″	−24.8	−38.0	−24.0	+62.0	+81.0	−31.4	−38.0	+173.0
Lid-reflex								
Amplitude, A′	−38.0	−33.6	+13.3	−17.7	−16.8	−35.8	−10.7	−18.0
Amplitude, A″	−57.0	−42.8	+25.7	−68.5	+65.8	−49.9	−103.9	−27.0
Progress in memorizing	+10.9	+ 2.5	− 5.9	+27.8	+57.0	+ 6.7	+ 2.5	+13.3
Number of finger movements	− 3.9	− 4.0	− 3.1	− 3.5	+ 7.1	− 3.9	− 8.9	−15.2
Section III								
Pulse Cycle Length								
Immediately before exercise	−11.6	− 3.9	−14.5	− 5.8		− 7.7	− 3.1	− 4.0
During severe exercise	+ 1.3	− 4.0	− 4.0	− 2.7		− 1.3	− 4.1	+ 6.0
Immediately after exercise	− 2.5	− 8.7	+ 2.5	− 1.2		− 5.6		
Average of other pulse data	−12.4	−12.2	−14.8	−12.9	−19.4	−12.3	− 3.0	− 3.5

Referring to one of the measurements placed in Section II of the table,—for example, the number of finger movements performed in 8 seconds,—we find that the percentages given under Periods 2 and 3 are −3.9, and −4.0 (average −3.9), showing a decrease in the number of finger oscillations on alcohol days as compared with the normal days. This decrease in approximately the same degree is found in Periods 4 and 5, while in 6 there is a change in sign, thus representing an increase in the number of finger oscillations. In comparison Dodge and Benedict find −8.9% and −15.2% the averages for the normal group and for Subject VI respectively. These values indicate that Subject VI in both series of experiments conforms to the group.

The percentile changes in the length of the pulse cycle are nearly all minus, indicating a decrease in the length of the individual pulse cycle which of course is equivalent to an increase in pulse rate per minute. The effect of Alcohol in producing a faster pulse is more pronounced with Subject VI than for the average of the normal subjects.

In general the various periods may be compared on the basis of the preponderance of plus or minus signs. In Section I, Period 2, all of the values are plus and range from 0.8 to 31.0, with a central tendency above 12%. In Section II the signs for Period 2 are with one exception minus and show a central tendency of about 19%. It should be borne in mind that plus in Section I and minus in Section II have the common meaning of inferior performance or depression. Period 3 is clearly more like 2 than it is like 4, while 2 and 3 averaged may be compared logically with the percentages for the normal group. The signs agree here almost exactly, measurement for measurement, although the percentages are naturally different. In the one clear case of disagreement, that is, eye reaction time, −5.4% for the normal group as against +15.9% for Subject VI in the second series of experiments, and −9.3% in the first series, it should be stated that Dodge and Benedict for this measurement found a decided practice effect for their subjects which masks the influence of the 30 cc. dose of alcohol. In the first series Subject VI is in harmony with the group. In the second series no practice effect is shown and the reaction time is lengthened. The plus and minus signs in the averages for Subject VI otherwise agree for the most part with his averages for Periods 2 and 3. Detailed discussion of the individual measurements cannot be given here but will appear in a fuller report soon to be published by the Carnegie Institution of Washington.

The two series of measurements for Subject VI taken together unmistakably indicate as a result of a dose of 30 cc. of absolute alcohol a lengthened reflex latency with a decrease in the amplitude of movement, slower reactions, slower coördinated movements, less sensitiveness to stimulation and an increase in pulse rate. The memory and word reactions, as in the earlier results, were improved after the alcohol.

Some attention should be given to the fact that in Period 6, and to a less extent in Period 5, in Sections I and II of the table, the signs are in the majority of cases the opposite of those in Periods 2 and 3 for similar measurements. This means a superior performance and is in contrast to the earlier condition of general depression. There are some indications in the data previously published that this facilitation following the alcohol depression may not be a peculiarity of Subject VI, but a characteristic phenomenon of the alcohol effect.

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[1] Dodge and Benedict, Psychological effects of alcohol, *Carnegie Inst. Washington, Pub.* 232, 1915; these PROCEEDINGS, 1, 605 (1915).

[2] For family and personal history see Dodge and Benedict, op. cit., p. 277.

[3] Rivers, *The influence of alcohol and other drugs on fatigue*, London, 1908.

THE INFLUENCE OF THE MARGINAL SENSE ORGANS ON METABOLIC ACTIVITY IN CASSIOPEA XAMACHANA BIGELOW

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The results of my earlier studies[1] have shown a marked influence of the marginal sense-organs on the rate of regeneration in *Cassiopea*, when halves of the same specimen are used for comparison. Further experiments on regeneration have confirmed these results, and have shown that when two halves of any medusa disk are subjected to the same operation the amount of regeneration from the two halves is identical in extent within the limits of error of measurement employed

Since the influence of the sense-organs on the rate of regenerations is most marked in the earlier stages of any experiment, several series of disks were (1) separated into halves, and (2) the sense-organs were then removed at different intervals of time after the first operation as shown in the following table:

TABLE 1

Series No.	*First operation Disk cut into 2 half disks*	*Second operation S. O. removed from one-half disk*	*Result*
1	9.45 a.m. July 22	7.00 a.m. July 23	Half with S. O. fastest
2	8.00 a.m. July 24	7.00 p.m. July 24	Half with S. O. fastest
3	7.15 a.m. July 25	8.00 a.m. July 26	Reg. equal
4	8.00 a.m. July 25	4.00 p.m. July 25	Half with S. O. fastest
5	7.00 a.m. July 26	8.00 a.m. July 27	Reg. equal